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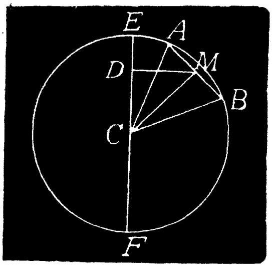

AB. Bisect AB in M, and draw CM, and also MD perpendicular to EF.

Let R be the radius of the circle, and $2a$ the length of the given chord. Put $\angle DCM=A$, and $CM=x$; then $DM=x\sin A$, and $AB=2(R^2-x^2)^{\frac{1}{2}}$.

If AB be revolved about EF, as an axis, the surface generated will be, $AB\times 2\pi DM=4\pi \sin A(R^2-x^2)^{\frac{1}{2}}x$; $\therefore$ the required volume is,

$$V=4\pi\sin A\int_{(R^2-x^2)^{\frac{1}{2}}}^{R}(R^2-x^2)^{\frac{1}{2}}x\,dx=\frac{4}{3}\pi\sin A.a^3.$$

This expression is independent of the radius of the circle. $\therefore$ The same volume will be generated by the segment of any circle, chord $2a$ and angle A remaining constant. When $\angle A=90^\circ$, $V=\frac{4}{3}\pi a^3$.

Professor Arthur E. Haynes gives a solution of this particular case of the problem, in *The Mathematical Magazine*, Vol. II. No. 6, page 88. If the segment is cut by the axis, the formula will, of course, give the difference between the volumes generated by the two divisions of the segment. $\therefore$ When $a=R$, we have, $V=\frac{4}{3}\pi\sin AR^3$, the volume generated by any sector, angle at the center being $2A$. When $A=30^\circ$, $V=\frac{2}{3}\pi a^3$. In this case the volume is just ½ as great as when $\angle A=90^\circ$.

Many other interesting cases will suggest themselves; those that I have considered will give some idea of the comprehensiveness of the formula.

Also solved by *F. P. MATZ*, *C. E. MYERS*, *J. F. W. SCHEFFER*, and *G. B. M. ZERR*.

Professor *J. C. NAGLE*, B. Sc., M. A., Department of Civil Engineering and Physics, Agricultural and Mechanical College of Texas, College Station, Texas, sent an excellent solution to prob. 8, after the April No. had gone to press.

PROBLEMS.

22. Proposed by MOSES C. STEVENS, M. A., Professor of Mathematics, Purdue University, Lafayette, Indiana.

Solve the following Differential Equation:—

$$(6x^3+20x^2-2x)\frac{d^2y}{dx^2}-(9x^2+10x+1)\frac{dy}{dx}+(1+9x)y=0.$$

23. Proposed by W. I. TAYLOR, Baldwin University, Berea, Ohio.

From a point O situated in the plane of a plane curve, radii vectores are drawn to different points of the curve, and on each one a distance is laid off from O inversely proportional to the length of the radius vector; to determine the tangent at any point of the locus of the points thus obtained. [*Byerly's Diff. Calculus, p. 177, ex. 1.*]

24. Proposed by C. W. M. BLACK, A. M., Department of Mathematics, Wilmington Conference Academy, Dover, Delaware.

At the President's reception, the citizens are admitted at 12:30, but the line begins to form at 11 in front of the gate. By the time the doors are opened, there are in line 5400 people, who have gathered at a rate per second proportional to the time after 11. The President is able to receive them at the rate of 45 per second. At what time should a person have joined the line to get through with the least delay?

Solutions to these problems should be received on or before September 1st.

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MECHANICS.

Conducted by B.F.FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

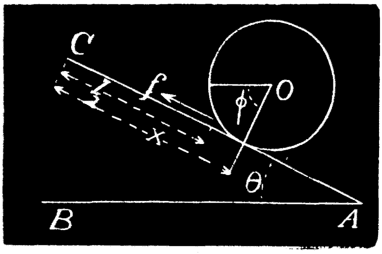
SOLUTIONS TO PROBLEMS.

7. Proposed by DeVOLSON WOOD, M. A., M. Sc., C. E., Professor of Engineering, Stevens Institute of Technology, Hoboken, New Jersey.

A hollow sphere filled with frictionless water rolls down a rough plane whose length is l and inclination θ; when half way down the water suddenly freezes and adheres to the sphere. Required the time of the decent.

Solution by J. C. NAGLE, M. A., C. E., M. C. E., Professor of Civil Engineering and Physics, Agricultural and Mechanical College, College Station, Texas.

Let the mass of water be m and the sphere a shell without weight. Then before freezing of the water the motion will be equivalent to simple sliding on a rough inclined plane.



Take origin at C, the point at which motion begins and let x be measured along the plane. Let f be the friction acting up the plane. The equation of motion for x less than $\frac{l}{2}$ is: $m\frac{d^2x}{dt^2}=mg\sin\theta-f\ldots.(1)$,

from which, by integration, $V=\frac{dx}{dt}=g\sin\theta.t-\frac{f}{m}t\ldots.(2)$,

$$\text{and } x=g\sin\theta t^2-\frac{f}{m}t^2\ldots.(3).$$

$$\text{When } x=\frac{l}{2},\ t=T\sqrt{\frac{ml}{2(mg\sin\theta-f)}}.$$